

Appl. No. 10/628,881
Amdt. Dated January 4, 2006
Reply to Office Action of October 5, 2005

Attorney Docket No. 81872.0049
Customer No.: 26021

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A surface acoustic wave device comprising:

a surface acoustic wave element including a piezoelectric substrate which includes one principal surface formed with an inter digital transducer electrode, a connector electrode connected to the inter digital transducer electrode and a periphery sealing electrode; and

a base substrate formed with an electrode for connection to the element that is connected to the connector electrode, and a periphery sealing conductor film joined to the periphery sealing electrode, ~~and an external terminal electrode; and~~
~~an outer covering resin layer attached to cover an another principal surface and a side surface of the surface acoustic wave element,~~

wherein the connector electrode and the electrode for connection to the element are joined together through a solder bump component, and the periphery sealing electrode and the periphery sealing conductor film are joined together through a solder sealing component ~~so that a predetermined gap is formed between~~ the base substrate and the surface acoustic wave element,

the solder bump component and the solder sealing component comprise a Sn-Sb based or Sn-Ag based lead-free solder containing 90% or more Sn, and

the base substrate has a thermal expansion coefficient of 9-20 ~~ppm/C~~
ppm/°C.

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2. (Original) The surface acoustic wave device according to claim 1, wherein the base substrate is a glass-ceramic substrate comprising glass-ceramics at interfaces among ceramic powder particles.

3. (Original) The surface acoustic wave device according to claim 1, wherein the base substrate is a resin substrate reinforced with an inorganic fiber.

4. (Original) The surface acoustic wave device according to claim 1, wherein a relationship of $(S1/L1) > (S2/L2)$ is satisfied where the area of a vertical cross-section of the solder bump component is S1, the area of a vertical cross-section of the solder sealing component is S2, the soldering width of a vertical cross-section of the connector electrode formed on the surface acoustic wave element is L1, and the soldering width of a vertical cross-section of the periphery sealing electrode of the surface acoustic wave element is L2.

5. (Original) The surface acoustic wave device according to claim 1, wherein the conductor width of the periphery sealing conductor film of the base substrate is larger than the electrode width of the periphery sealing electrode of the surface acoustic wave element, and the configuration of an inner periphery of the periphery sealing conductor film and the configuration of an inner periphery of the periphery sealing electrode are generally identical to each other.

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6. (Original) The surface acoustic wave device according to claim 5, wherein the periphery sealing conductor film has a substantially uniform conductor width throughout the entire path thereof, and the width of the solder sealing component joined to the periphery sealing conductor film is identical to the conductor width of the periphery sealing conductor film.

7. (Currently amended) A surface acoustic wave device comprising:

a surface acoustic wave element including a piezoelectric substrate which includes one principal surface formed with an inter digital transducer electrode, a connector electrode connected to the inter digital transducer electrode and a periphery sealing electrode; and

a base substrate which is formed with an electrode for connection to the element that is connected to the connector electrode, and a periphery sealing conductor film joined to the periphery sealing electrode ~~and an external terminal electrode,~~

wherein the connector electrode and the electrode for connection to the element are joined together through a solder bump component, and the periphery sealing electrode and the periphery sealing conductor film are joined together through a solder sealing component ~~so that a predetermined gap is formed between the base substrate and the surface acoustic wave element,~~

a side surface covering resin layer is attached to cover a side surface of the surface acoustic wave element and an outer peripheral surface of the solder sealing component, ~~and the side surface covering resin layer has an elastic modulus which follows a change of a gap between the base substrate and the surface acoustic wave element caused by volume expansion of the solder bump component and the solder sealing component at a melting temperature of the solder bump component and the~~

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solder sealing component wherein the side surface covering resin layer has an elastic modulus of 3.5-6 GPa at 25 °C and an elastic modulus of 0.2-0.4 GPa at 230 °C.

8. (Original) The surface acoustic wave device according to claim 7, wherein the side surface covering resin layer comprises a resin having thermal reversibility.

9. (Canceled)

10. (Currently amended) The surface acoustic wave device according to claim 7, wherein a mass per unit volume at temperatures between 180 °C and 250 °C of the surface acoustic wave element and the side surface covering resin layer is smaller than a mass per unit volume at temperatures between 180 °C and 250 °C of the solder bump component and the solder sealing component.

11. (Original) The surface acoustic wave device according to claim 7, wherein a space formed by the surface acoustic wave element, the base substrate and the solder sealing component is hermetically filled with air or an inert gas including nitrogen.

12-21. (Canceled)

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22. (New) A surface acoustic wave device comprising:

a surface acoustic wave element including a piezoelectric substrate which includes one principal surface formed with an inter digital transducer electrode, a connector electrode connected to the inter digital transducer electrode and a periphery sealing electrode; and

a base substrate which is formed with an electrode for connection to the element that is connected to the connector electrode, a periphery sealing conductor film joined to the periphery sealing electrode and an external terminal electrode,

wherein the connector electrode and the electrode for connection to the element are joined together through a solder bump component, and the periphery sealing electrode and the periphery sealing conductor film are joined together through a solder sealing component so that a predetermined gap is formed between the base substrate and the surface acoustic wave element,

a side surface covering resin layer is attached to cover a side surface of the surface acoustic wave element and an outer peripheral surface of the solder sealing component, and the side surface covering resin layer has an elastic modulus which follows a change of a gap between the base substrate and the surface acoustic wave element caused by volume expansion of the solder bump component and the solder sealing component at a melting temperature of the solder bump component and the solder sealing component,

wherein the conductor width of the periphery sealing conductor film of the base substrate is larger than the electrode width of the periphery sealing electrode of the surface acoustic wave element, and the configuration of an inner periphery of the periphery sealing conductor film and the configuration of an inner periphery of the periphery sealing electrode are generally identical to each other.